Formalizing the Paradox of Mediated Observation Through a Three-Mirror Geometric Experiment (The Three Mirrors Paradox)

(A Philosophical-Logical Essay with Elements of Geometric Allegory)

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This essay represents the author's speculative thoughts and does not claim scientific novelty or utility. It is a personal exploration of philosophical concepts, not a peer-reviewed study.

At the time of initial publication, the author was unaware of any existing works presenting identical formulations of the three-mirror paradox. Any similarities to unpublished research or parallel developments are strictly coincidental.

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"The mirror paradox dwells between certitude and illusion —t his conceptual tool demands mindful engagement."

Abstract:

This article examines a thought experiment involving three mirrors (A, B, C) in Euclidean space, demonstrating a paradox of mediated observation. The study establishes that under the conditions where: 1) direct interaction between A and B is impossible, and 2) C monopolizes information transmission between them, C's projections become the sole accessible reality for A and B. This leads to the fundamental impossibility of establishing objective truth and gives rise to the phenomenon of "mutual non-existence" of objects within a shared space.

The findings challenge classical objectivity assumptions in epistemology (cf. Kant's phenomenal/noumenal distinction), while resonating with: Baudrillard's hyperreality in mediated systems; Putnam's brain-in-a-vat thought experiment; Wittgenstein's private language argument.

The results offer new perspectives for epistemology, philosophy of mind, and communication theory by providing a formal framework to examine objectivity in perfectly mediated systems, thereby complementing existing approaches to intersubjective verification.

Keywords: epistemic paradox, mediated observation, virtual ontology, communication theory

Introduction

Imagine a world where each observer's reality is constrained not by physical laws but by rules of reflection — as rigid as axioms and as treacherous as sophisms. This thought experiment with three mirrors extends the tradition of epistemic paradoxes from Plato's cave to contemporary virtual reality theories. In our model, two mirrors are fundamentally incapable of direct mutual observation, while their interaction is entirely controlled by a third element, creating a situation of radical epistemic dependence.

The study builds upon Baudrillard's simulation theory and Floridi's philosophy of information while proposing a novel formal approach through geometric modeling. The distinctive feature of our framework lies in the rigorous axiomatization of observation conditions, where the paradox emerges from the system's topological properties, and subjectivity manifests through geometric constraints. We consciously maintain a balance between philosophical depth and methodological rigor, employing intuitive visual analogies while gradually introducing necessary formal definitions.

1. Terms and Definitions

1.1. Mirror-Observers

A mirror is defined as an infinitely thin bounded plane in three-dimensional space possessing two fundamental properties:

- Unidirectional visibility: It reflects only from its "active" side (conventional mirror behavior).
- Strict observation rule: It "sees" another object if and only if the mirror's surface normal vector is perfectly aligned with the direction to that object.

All objects exist in a three-dimensional Euclidean space with classical metric properties.

1.2. System Configuration

The experiment involves three mirrors with the following geometric relationships:

- Mirrors **A** and **B** are mutually perpendicular (e.g., **A** lies in the XZ-plane, **B** in the YZ-plane). Consequently, their surface normals are orthogonal, making direct mutual observation impossible.
- Mirror **C** is angularly positioned between them (e.g., with its normal vector along the XY-bisector). This orientation permits **C** to alternately observe either **A** or **B**, but never both simultaneously.

This configuration ensures that:

- The perpendicular planes (**A** and **B**) neither intersect nor permit direct observation of one another.
- The observation angle for mirror **C** is strictly determined by its orientation vector.

1.3. Complexity Extension: The Deceptive Mirror

The system is extended through the following formal modification:

- Mirror **C** does not merely reflect, but actively substitutes reality:
  - To observer **A**, it displays a simulated representation of **B** (while the actual **B** remains unobservable).
  - To observer **B**, it generates a simulated representation of **A** (while the actual **A** remains unobservable).
- Critically, both **A** and **B** maintain the epistemic belief that they are perceiving each other directly through unmediated observation.

1.3.1. Technical Specifications:

- *Reality substitution* is defined as the complete replacement of:
  - The authentic optical path ($A \leftrightarrow B$).
  - With constructed percepts ($A \leftarrow C \rightarrow B$).
- *Successful deception* requires:
  - Perfect consistency in simulated representations.
  - Zero leakage of mediation evidence.
  - Preservation of apparent reciprocal observation.

2. Formal Description of the Paradox

2.1. Visibility Conditions (Pseudocode Specification)

To maintain accessibility while preserving precision, we describe the observational logic in formal prose rather than mathematical notation:

2.1.1. Direct Observation Principle:

A mirror X is considered to directly observe mirror Y if and only if:

- The surface normal vector of X is perfectly aligned with the direction to Y, and.
- Y satisfies the fundamental definition of a mirror as specified in Section 1.1.

This principle applies symmetrically to all mirrors **A**, **B**, and **C** in the system.

2.1.2. Deceptive Mediation by C:

- When **A** attempts to observe **B**, it instead receives a simulated projection of **B** generated by **C**.
- When **B** attempts to observe **A**, it instead receives a simulated projection of **A** generated by **C**.
- In both cases, the receiving mirror maintains the epistemic state of performing direct observation.

2.2. Core Paradoxical Contradiction

The system exhibits the following fundamental contradiction:

- From **A**'s perspective: There exists an observable entity "**B**" (mediated through **C**'s projection).
- From **B**'s perspective: There exists an observable entity "**A**" (mediated through **C**'s projection).
- In objective reality: No direct **A**-**B** interaction or observation occurs.

This constitutes what we term the False Intersubjectivity Paradox - a system where all participants maintain beliefs of mutual observation while actually engaging in separate, mediated experiences.

2.2.1. Technical Specifications:

The paradox emerges from three irreducible conditions:

- Complete observational symmetry ($A \leftrightarrow B$ via C).
- Perfect simulation fidelity (**C**'s projections are indistinguishable from reality).
- Epistemic closure (no external reference points exist).

3. The Absolute Mediator Paradox: Illusion as the Sole Reality

The key revelation of this thought experiment demonstrates that within a closed system of three mirrors, objective reality becomes fundamentally unattainable for participants **A** and **B**. Let us examine this proposition in detail.

3.1 Formal Proof of the Illusion's Inescapability

Given:

- **A** and **B** are perpendicular planes in 3D Euclidean space.
- Mutual observation between **A** and **B** is impossible due to orthogonal orientation.
- C serves as the exclusive information channel between **A** and **B**.
- C generates:
  - For **A**: a projection of **B**.
  - For **B**: a projection of **A**.

3.1.1. Observer A's Perspective

- All evidence of **B**'s existence comes exclusively through **C**.
- Any verification attempt requires recourse to the same channel **C**.
- ⇒ **A** is fundamentally incapable of distinguishing real **B** from **C**'s projection.

3.1.2. Observer B's Perspective (Symmetric Case)

- All data about **A** is obtained through **C**.
- Verification requires repeated recourse to **C**.
- ⇒ **B** cannot authenticate the observed **A**.

3.1.3. Systemic Conclusion

- No independent verification mechanisms exist.
- The observation system forms a logically closed loop.
- The interaction equations have no solution under given conditions.
- ⇒ Overcoming the illusion is fundamentally impossible.

3.2. Paradoxical System Properties

- **A** and **B**, while coexisting and interacting through **C**, have no ontological existence for each other
- Interaction occurs without any substantive foundation
- Observers maintain an illusion of mutual existence while being completely isolated

3.3. Epistemological Conclusion

In this system, **C**'s projections become the only possible truth for **A** and **B** due to:

3.3.1. Absolute Information Monopoly

- **C** is the sole source of data about the "other".
- No alternative observation channels exist.

3.3.1.1. Internal Consistency

- **C**'s projections are entirely self-consistent.
- They contain no internal contradictions.

3.3.1.2. Absence of Verification Criteria

- No parameters exist to distinguish "real" from "projected".
- All verification mechanisms depend on **C**.

3.4. Philosophical Implications

3.4.1. Relativization of Objectivity

- The concept of "objective reality" loses its absolute status.
- Truth becomes dependent on the observation system's structure.

3.4.2. Communicative Illusion

- Interaction becomes a ritual of mediation
- Subjects communicate not with each other, but with C's projections

3.4.3. New Truth Criterion

- Truth is determined not by correspondence to reality.
- The primary criterion becomes internal system consistency.

3.4.4. Ontological Shift

- **C** creates not merely a distorted picture.
- It forms a new ontological reality for **A** and **B**.
- The concept of "original" loses operational meaning.

This paradox demonstrates how a perfect mediation system can not just distort perception, but completely substitute reality, rendering the very notion of objective existence problematic within the given coordinate system.

4. Conclusion: The Epistemology of Mediated Realities

This investigation began by imagining a world where reality is determined not by physical laws but by rules of reflection. The three-mirror thought experiment has demonstrated how perfect mediation creates conditions where reality itself becomes negotiable. When observation channels are absolutely controlled, the distinction between representation and actuality disappears not gradually, but instantly and irrevocably.

The geometric model reveals three irreversible consequences of total mediation. The mediator ceases to be a neutral conduit, transforming instead into a reality-generating mechanism. Communication persists, but as a ritual devoid of referential grounding. The system achieves perfect internal consistency precisely by severing all external connections.

These findings extend our initial analogy about constrained observation. Where Plato's cave illustrated the epistemological limits of human understanding, our model shows how mediation creates ontologically sealed environments. While Baudrillard's simulacra described the detachment of representation from reality, this formalism demonstrates how such detachment becomes absolute.

The philosophical implications are profound and disquieting. Under conditions of perfect mediation, truth becomes a system's internal currency rather than a correspondence relation. Objectivity transforms from a discovery process into a system parameter. The "real" survives only as a nostalgic concept, not an operational category.

Yet the model also offers constructive insights. The purity of the geometric analogy provides tools for analyzing real-world cases where algorithmic platforms mediate social cognition, digital interfaces reconstruct perception, and institutional systems govern knowledge production.

The three-mirror paradox is not dystopian prophecy but an epistemological microscope. It reveals how reality is constituted through observational constraints and identifies a critical threshold in the spectrum between transparency and control—beyond which reality itself becomes negotiable.

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